Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

ON LEMURINE REVERSION IN HUMAN DENTITION.

BY E. D. COPE.

DESCRIPTIONS of the molar teeth of man, given by anatomists, differ in important respects. Thus F. Cuvier (Dents des Mammifers) states that while the crown of the first superior true molar consists of four tubercles, those of the second and third superior true molars consist of but three tubercles. In the American edition of "Sharpey and Quain's Anatomy" it is stated that the crowns of the superior true molars of man consist of four tubercles, and the same statement is made in Allen's late work on human anatomy.

My observations having shown me that both of these descriptions apply correctly to certain types of dentition, I determined to examine for myself to ascertain, if possible, the extent and value of the variations thus indicated. My interest in the subject had been especially stimulated by the researches among the extinct Mammalia and the results which I had derived from them. These are in brief as follows: First, the quadritubercular type of molar crown illustrated by the first superior true molar of man belongs to the primitive form from which all the crested upper (lophodont) molars of the hoofed placental mammals have been derived; and second, this quadritubercular type of molar has itself been derived from a still earlier tritubercular crown by the addition of a cusp at the posterior internal part of it. This tritubercular molar in the upper series has given origin directly to the superior sectorial teeth of the Creodonta and Carnivora. In the inferior series I have shown that in known placental Mammalia, at least, the primitive molar crown is quinquetubercular or tritubercular with a posterior heel; that this form gave origin to the inferior sectorial tooth of Carnivora by modification; and to the quadritubercular type, corresponding to the superior quadritubercular crown, by a loss of the anterior inner angle and cusp. And from the quinque and quadritubercular types of lower molar crown the various specialized types of the ungulates have been derived.

Considerable significance, therefore, attaches to the question as to whether the superior true molars of *Homo sapiens* are quadritubercular or tritubercular. The inferior molars are also either quadritubercular or quinquetubercular, but less significance attaches to this modification than to that of the superior true molars.

This is owing to two facts, viz., the fifth tubercle is not the anterior inner which completes the anterior triangle of the primitive inferior molar, but is a median posterior, such as is not uncommon in Mammalia of Puerco and Eocene age; and second, because this tubercle is of quite small size and is, therefore, more liable to variation from insignificant causes.

In the nearest allies of man, the anthropoid apes, the superior true molars are quadritubercular, the posterior internal tubercle of the last or third molar being usually smaller than in the other molars in the chimpanzee. The inferior molars are quinquetubercular in the human sense, the gorilla not infrequently adding a sixth lobe on the external posterior margin of the crown. The molars of both series are quadritubercular, with an occasional posterior fifth in the inferior molars, in the Semnopithecidæ and Cebidæ, excepting the genus Pithecia of the latter, where the superior molars are tritubercular. The superior molars of the Hapalidæ are tritubercular. In the Lemuridæ the second and third, and frequently the first superior true molars, are tritubercular. In the Tarsiidæ the superior true molars are tritubercular throughout. The superior molars of the extinct lemuroids differ like those of the recent forms. Thus in Adapis and its allies they are quadritubercular, but in Necrolemur they are tritubercular. In Chriacus (whose reference to the Lemuroidea is uncertain) they are tritubercular, as is the case also with Indrodon. In Anaptomorphus they are of the true tritubercular type. This is the genus of Lemuroidea, which in its dental character most nearly approaches the anthropoid apes and man, as I have elsewhere[1] pointed out. The formula is I. $\frac{2}{2}$; C. $\frac{1}{1}$; Pm. $\frac{2}{2}$; M. $\frac{3}{3}$. The canines are small and there is no diastema in either jaw.

It may be readily seen in consideration of these facts that the appearance of tritubercular superior molars in the genus Homo constitutes a reversion to the lemurs, and not to the anthropoid apes or to the monkeys proper. And among lemurs the reversion is most probably to that type which presents the closest resemblance to Homo in other parts of the dentition. The genus which answers most nearly to this requirement among those at present known is Anaptomorphus.

In studying the dentition of man, I have examined the crania contained in the following five collections: those of the Academy of Natural Sciences of Philadelphia; of the Army Medical Museum of Washington; of the College of Physicians of Philadelphia; of the University of Pennsylvania, and of my own museum. The first of these is especially valuable on account of the negro, Egyptian and Hindoo crania it contains. My acknowledgments are due to the Board of Curators, of which Professor Leidy is chairman, for the opportunity of studying it. The collection of the Army Medical Museum at Washington is especially important on account of the Kanakas, Esquimaux, Peruvians and North American Indians which it possesses. I am under great obligations to its distinguished director, Dr. J. S. Billings, for the facilities which he placed at my disposal. The museum of the Philadelphia College of Physicians contains the collection made by the late Professor Hyrtle, of Vienna, of crania of Eastern and Mediterranean Europeans. In this department it is unrivaled, and I am greatly indebted to the council of the college, and its curator Dr. Guy Hinsdale, for the opportunity of examining it. Some French skulls in the University of Pennsylvania were of value in the investigation. My own collection, though small, contains a number of Maoris, Australians, Tahitians and North American Indians, which have proved to be of importance. Of English and Anglo-American crania I have been able to examine but few of what might be termed the thoroughly amalgamated race. Of the latter there are probably many crania in the war collection of the Army Medical Museum, but how free the race of each may be from foreign intermixture, of course, it is impossible to know. In selecting such as are supposed to be "stock Americans," those of persons with English names have been preferred, although many now true Americans are of German ancestry. In order to increase the list of this class of examinations, I have imposed on the forbearance of my friends by frequent inspections of their dentitions in *ore aperto.*

---

[1] Report U. S. Geol. Survey Terrs. F. V. Hayden. Vol. III, 1885, p. 245, Pl. xxive, fig. 1, and Pl. xxv, fig. 10; and AMERICAN NATURALIST, 1885, p. 466, fig. 12.

I suspect that the characters thus obtained will prove of importance in a zoölogical and ethnological sense. They have been already found to be of great fixity, and hence significance, in the lower Mammalia. The only reason why they should be less so in man is that the modification in reverting to the tritubercular molar is a process of degeneracy, and may be hence supposed to be less regular in its action than was the opposite process of building up, or addition of the posterior internal cusp. Some justification for a light estimate of its value may be found in the following tables. But it must be remembered that it is not always possible to determine exactly the race of the person represented by a skull even when care in its identification has been exercised. Emigration and war have constantly rendered races impure, and transplantation on a large scale has in some parts of the earth produced hybrid races. The results of a study of human crania are sure to be more or less vitiated by these circumstances. We obtain averages rather than exact definitions. Nevertheless the extremes of the series of variations are likely to be found to be characteristic of established forms of man, and will thus justify my belief in the value of the characters presented. To ascertain the relation of these variations to the races is the object of the present enquiry.

The cause of the tritubercular reversion belongs to the class of agencies active in evolution of organic types of whose real nature we know little. It can not be said to be due to a contraction of the maxillary arcade, for the Esquimaux and some other peoples which display the tritubercular dentition are not deficient in this respect. Tritubercular molars do not require less length than the quadritubercular, for the external width of the crown is the same in both cases. They require less material, however, than a quadritubercular crown, since a triangle is smaller than a square drawn on the same base line; however in some men of the lower races who present the tritubercular molars, their outline is nearly square. The hypothesis advanced[1] to account for the reduction of the number and quality of human teeth observed in the higher races, as well as for the replacement of the prognathous jaw by the orthognathous, is that such changes are due to a transference of material and of growth-energy from these parts to the superior part of the skull and its contents. The relative superiority of the dimensions of these latter parts in the higher races is supposed to account for the reduction of size of the jaws.

In the following tables the tubercular formulæ are represented by numbers. Only the last three, or the true molars, in each jaw are considered. Tubercles of reduced size are represented by fractions. Thus $\frac{4-4-4}{5-5-5}$ indicates that each superior molar is quadritubercular, and each inferior molar quinquetubercular. This represents the extreme of the series represented by the lowest races. The formula $\frac{4-3-3}{4-4-4}$ indicates that the true molars have four, three and three tubercles respectively, and that the inferior true molars have four each. This represents the extreme common among the higher races.

---

[1] Proceeds. Amer. Philos. Soc., 1871, p. 252.

For clearer understanding of these characters they are arranged in the form of a table. Only the principal races are represented, and hybrids, when determinable, are omitted.[1] The characters of the superior molar teeth only are referred to. These are classified under four heads, viz., first, tubercles 4—4—4; second, tubercles 4—4—3½ or 4—3½—3½; third, tubercles 4—3½—3; fourth, tubercles 4—3—3. As already remarked, the extreme types of the series give the most precise indications of race, while the intermediate conditions have a various range.

In the first table the most obvious results are, that only the three lowest races present four tubercles on all the superior molars, and that of those with tritubercular second and third

	4—4—4	(4—4—?)	4—4—3½ 4—3½—3½ 4—4—3	4—3½—3	4—3—3	Totals,
Totals	17	19	109	44	89	278
Europeans and Europeo-Americans			39	24	56	119
Esquimaux and Chuktchi			6	3	19	28
Hindus			3	1	2	6
Chinese and Japanese		3				3
N. American Indians		1	17	5	8	31
Peruvians		2	9	1	2	14
Negroes and Egyptians	7		16	5		28
Australians and Micronesians	4	13	23	2	2	44
"Malays" (? Nigritos)	6		1	3		10

---

[1] Mulattoes, Mestizoes, Half-breed Indians, Gypsies, etc., are omitted.

molars, Europeans and their American descendants greatly predominate. Also that of uncivilized races the Malays and Negroes never, and Micronesians very rarely, present this type of dentition, while in the Esquimaux it considerably predominates.

I now give a table of the characters of the superior molars in the Europeans and Europeo-Americans examined. The number is not sufficient for final conclusions; nevertheless there are some indications of value. Some of the one hundred and nineteen dentitions examined are referred with doubt to their respective races. Thus the Europeo-Americans may have been in many instances immigrants, as many such left their bones on the battlefields of the American Civil war, where many of the crania were picked up. The supposed Germans are largely Austrians, so that some of them may be more or less Slavic or Majyar.

	4—4—3½	4—3½—3½	4—4—3	4—3½—3	4—3—3	Totals,
Totals	11	10	18	24	56	119
Europeo-Americans	3	2	3	2	20	30
French	1			1	6	8
Germans and Scandinavians	2	3	3	8	6	22
Greeks and Italians	3	3	7	3	7	23
Western Asiatics		1		2	4	7
Slavs	2	1	5	6	11	25
Majyar				1	2	3
Lapps and Finns				1		1

As results we have the following: The tritubercular dentition appears in eleven out of twenty-five Slavs; in seven out of twenty-three Greeks and Italians; in six out of twenty-two Germans and Scandinavians; in six out of eight French, and in twenty out of thirty Europeo-Americans. The only great race which presents a similar high percentage of tritubercular molars is the Esquimaux, where they occur in nineteen out of twenty-eight dentitions. The tendency is most marked in Slavs, French and Europeo-Americans, and is least marked in Greeks and Italians, and in Germans. These two subraces stand in the series between the intermediate type of the North American Indians and the other Europeans. I have seen no English dentitions.

It is important to remember in this connection that the distinguished ethnologist and archæologist, W. Boyd Dawkins, affirms that the earliest inhabitants of Britain and some other parts of Europe were Esquimaux. He refers especially to the men of the caves, whose implements and arts he declares to be identical with those used by the Esquimaux of the present day.[1] As it is evident that the lemurine or tritubercular reversion commenced with the Esquimaux, it may be that in some instances at least its appearance in men of Anglo-Saxon and other European races is due to inheritance alone. But it is reasonable to suppose that in this case, as in other evolutions, the cause which produced this modification of the Esquimaux dentition is still active, and its frequent appearance in the most civilized races may be due to this cause as well. The progressive character of the French dentition in this respect is in broad contrast with the primitive character of that of Italians and Greeks. The characters seen in the latter go far towards sustaining Professor Huxley's hypothesis that the dark Mediterranean subraces consist of a mixture of Egyptian with the Indo-European stock.

In conclusion it may be stated that the tritubercular superior molars of man constitute a reversion to the dentition of the Lemuridæ of the Eocene period of the family of Anaptomorphidæ. And second, that this reversion is principally seen among Esquimaux and the Slavic, French and American branches of the European race.

---

[1] Early Man in Britain, 1880, p. 233.